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Keystrokes

7.5 Graph Logarithmic Functions

QUESTION **How can you graph logarithmic functions on a graphing calculator?**

You can use a graphing calculator to graph logarithmic functions simply by using the LOG or LN key. To graph a logarithmic function having a base other than 10 or e, you need to use the change-of-base formula to rewrite the function in terms of common or natural logarithms.

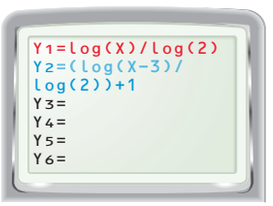
EXAMPLE **Graph logarithmic functions**

Use a graphing calculator to graph $y = \log_2 x$ and $y = \log_2 (x - 3) + 1$.

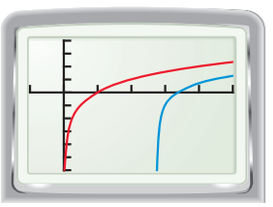
STEP 1 ***Rewrite functions*** Use the change-of-base formula to rewrite each function in terms of common logarithms.

$$y = \log_2 x \qquad y = \log_2 (x - 3) + 1$$
$$= \frac{\log x}{\log 2} \qquad = \frac{\log (x - 3)}{\log 2} + 1$$

STEP 2 ***Enter functions*** Enter each function into a graphing calculator.



STEP 3 ***Graph functions*** Graph the functions.



PRACTICE

Use a graphing calculator to graph the function. 1–12. See margin.

1. $y = \log_4 x$
2. $y = \log_8 x$
3. $f(x) = \log_3 x$
4. $y = \log_5 x$
5. $y = \log_{12} x$
6. $g(x) = \log_9 x$
7. $y = \log_3 (x + 2)$
8. $y = \log_5 x - 1$
9. $f(x) = \log_4 (x - 5) - 2$
10. $y = \log_2 (x + 4) - 7$
11. $y = \log_7 (x - 5) + 3$
12. $g(x) = \log_3 (x + 6) - 6$

13. **REASONING** Graph $y = \ln x$. If your calculator did not have a natural logarithm key, explain how you could graph $y = \ln x$ using the LOG key. See margin for art; $\ln x = \log_e x = \frac{\log x}{\log e}$.

1 PLAN AND PREPARE

Learn the Method

- Students will learn how to use a graphing calculator to graph logarithmic functions. This gives an alternative to graphing these functions by hand, as described in Lesson 7.4.

Keystroke Help

Keystrokes for several models of calculators are available in blackline format in the *Chapter 7 Resource Book*.

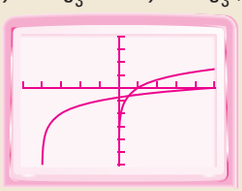
2 TEACH

Tips for Success

Students who do not get the correct graphs are probably entering the functions incorrectly. Check the keystrokes that they have used. They may have made errors with parentheses. Have these students follow the keystrokes in Step 2 of the Example and adapt these as needed.

Extra Example

Use a graphing calculator to graph $y = \log_3 x$ and $y = \log_3 (x + 4) - 2$.



3 ASSESS AND RETEACH

Why must the change-of-base formula be used if the base is not 10 or e? **A graphing calculator has logarithm keys only for base 10 and for base e.**

1–12. See Additional Answers beginning on p. AA1.

13.